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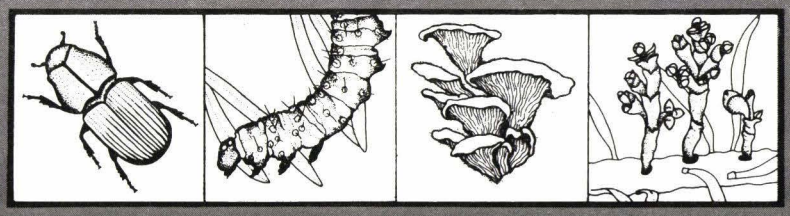

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MERIA NEEDLECAST OF WESTERN LARCH SEEDLINGS AT THE USDA FOREST SERVICE NURSERY, COEUR D'ALENE, IDAHO

by

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ABSTRACT

Needlecast caused by Meria laricis caused serious losses of 2-0 bareroot western larch during 1983 at the USDA Forest Service Nursery, Coeur d'Alene, Idaho. Cool, wet weather throughout the spring and summer of 1983 was ideal for disease buildup and spread. Control attempts with fungicides were largely unsuccessful because of the conducive weather conditions and high inoculum levels. The disease was also found on containerized larch, although serious damage was not evident. The 1984 bareroot crop had high levels of infection in the spring, but consistent fungicide treatments and warm, dry summer weather resulted in no detectable disease by the fall.

INTRODUCTION

During the 1983 growing season, bareroot western larch (Larix occidentalis Nutt.) seedlings at the USDA Forest Service Nursery, Coeur d'Alene, Idaho were devastated by a disease that caused severe defoliation and necrotic foliage (figure 1). Many of the smaller seedlings were killed and defoliation continued throughout much of the growing season. Examination of necrotic needles under magnification revealed presence of sporulating structures protruding through stomata on the underside of needles.

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Figure 1.--Bareroot western larch seedlings with severe infection by Meria laricis at the USDA Forest Service Nursery, Coeur d'Alene, Idaho.

Microscopic examination (100-450X) of these sporulating structures indicated that they were of the fungus Meria laricis Vuill. Examinations of many affected seedlings indicated that M. laricis was most frequently associated with disease symptoms and likely the major cause of the malady.

Needlecast caused by M. laricis is a common disease of native western larch stands in the northern Rocky Mountains (Dubreuil 1982). The disease was first described in northern Idaho in 1942 (Ehrlich 1942), but probably occurred much earlier and may have been confused with other larch foliage diseases (Weir 1913). Occurrence of M. laricis on larch nursery stock has been well documented in Europe (Peace and Holmes 1933), but the disease has been reported only recently in North American nurseries (Cooley 1984).

This report describes the disease caused by M. laricis on both bareroot and containerized seedlings at Coeur d'Alene, efforts to reduce losses, and first-year outplanting survival of infected stock.

OBSERVATIONS

2-0 Bareroot Larch-1983

Bareroot western larch is usually very sensitive to early spring frost damage at the Coeur d'Alene Nursery. Damage often results when below freezing temperatures occur shortly after budbreak and needle emergence. During the early spring of 1983, growers noticed extensive needle necrosis that was attributed to frost damage. Although spring weather during 1983 was cold and rainy, this was not unusual for Coeur d'Alene. However, the abnormally wet conditions persisted throughout much of the summer with only infrequent periods

of dry weather. Warm, dry conditions usually become common by mid-July and persist through September. The extensive needle necrosis that occurred in the spring intensified throughout the summer and many of the smaller seedlings were killed. When cause of the disorder was confirmed, growers began applying fungicides (alternating benomyl and chlorothalonil). Fungicides were applied at weekly intervals or more frequently if rain closely followed spraying.

When the crop was lifted in the fall of 1983, most of the smaller and heavily defoliated seedlings were culled. Only the larger seedlings with well-formed buds were shipped for outplanting. This extensive culling resulted in only 50 percent of the expected number of seedlings being available for outplanting. Lifted seedlings were stored under normal conditions over the winter.

Seedlings were outplanted during the spring of 1984. First-year-survival counts for the Northern Region were completed by the fall of 1984 to determine the effect of the disease following outplanting. Results are summarized in table 1.

Table 1.--First-year outplanting survival of bareroot western larch seedlings infected with Meria laricis at the USDA Forest Service Nursery, Coeur d'Alene, Idaho.

National Forest	No. Stands Surveyed	Avg. Percent Survival
Bitterroot	1	60.0
Idaho Panhandle	5	74.0
Clearwater	7	57.1
Flathead	18	65.0
Kootenai	44	64.0
Lolo	5	80.0
Nezperce	5	84.6
Region-wide	85	66.3

Outplanting survival ranged from almost 85 percent on the Nezperce National Forest to about 57 percent on the Clearwater National Forest. Average first-year survival for the Region approximated 66 percent, which is much below normal (Laird, personal communication). Most of the outplanted seedlings that died were the shorter ones with less caliper, although very short, heavily defoliated seedlings were culled at the Nursery. In a similar study of outplanting survival of larch seedlings severely infected with M. laricis (Cooley 1981), 3-month survival was about 85 percent. However, survival at the end of the first growing season was not reported and may have been less.

While many infected seedlings survived following outplanting, heavily infected larch seedlings are not a good risk for survival in the field. Their vigor may be so low that they are unable to withstand the shock of transplanting. Latent infections from the Nursery could also cause problems when seedlings are outplanted.

Containerized Larch-1983

During the late summer of 1983, routine examination of diseased containerized larch seedlings revealed presence of *M. laricis* sporulating on the underside of necrotic needles. This was the first time the pathogen was observed on containerized larch at Coeur d'Alene. *Meria laricis* apparently has not been reported previously on containerized larch seedlings in nurseries.

Sources of inoculum for containerized stock were likely the infected bareroot seedlings, although these seedlings were not growing adjacent to greenhouses. The fungus spreads from spores which are primarily rain-splashed (Peace and Holmes 1933). However, there may have been some air dispersal of spores or inoculum could have been introduced into greenhouses by workers or equipment.

A systematic survey of the occurrence of *M. laricis* on containerized larch was not conducted. The pathogen was found on several diseased seedlings randomly selected for examination. Its relationship with *Botrytis cinerea* Pers. ex Fr., the major disease of containerized larch (James 1984), is unknown. The two pathogens may commonly occur together or presence of *M. laricis* on containerized larch may have been unusual.

2-0 Bareroot Larch-1984

When *M. laricis* was confirmed on 2-0 bareroot stock late in the 1983 growing season, 1-0 larch seedlings in nearby beds were also examined for the disease. Although the pathogen was found on this stock, damage levels were much less than on the 2-0 seedlings. Nevertheless, fungicides were sprayed on 1-0 stock to keep damage low.

During the spring of 1984, the 1-0 (now 2-0) stock was reexamined for presence of *M. laricis*. The fungus was found sporulating abundantly on attached necrotic needles produced the previous year. Newly emerged foliage adjacent to these necrotic needles often had brown lesions, indicating probable infection by *M. laricis*.

Growers began spraying these seedlings with benomyl and chlorothalonil shortly after budbreak. Applications were made at biweekly intervals, unless interrupted by rain, and continued until about mid-July. Weather during the spring of 1984 was cold and wet, but warm, dry conditions began in early July and persisted throughout the summer. Even though the disease was so noticeable during the spring, it was not evident during most of the summer and could not be detected by fall. A combination of fungicide applications and the warm, dry weather during the summer probably accounted for the lack of disease by the time seedlings were lifted in the fall.

Containerized Larch-1984

During the summer of 1984, containerized larch were examined periodically for infection with *M. laricis*. Unlike the seedlings examined the previous year, no sign of infection or sporulation by the fungus was found.

DISCUSSION

Losses from M. laricis to bareroot western larch seedlings during 1983 were very significant. The disease probably occurred periodically at the Nursery before, but impact was not serious. A combination of abundant inoculum from the previous season and ideal weather conditions for buildup and spread of infection throughout the spring and summer resulted in multiple disease cycles during the growing season. By the time fungicides were applied, disease levels were so high that the chemicals had little effect. Rates of outplanting survival of infected seedlings were much less than desired or than normally occur with western larch. Apparently, the disease reduced vigor of seedlings enough to greatly limit their chances for survival.

The situation in the spring of 1984 indicated that losses might again be serious. High levels of infection were evident and conducive weather conditions prevailed throughout the spring. However, early and repeated fungicide applications probably kept inoculum levels lower than the previous year. Another important factor restricting disease development was the onset of warm, dry weather in July. Previous experience with Meria needlecast indicates that moisture and cool temperatures are required for spore production, dissemination, and germination (Dubreuil 1982; Peace and Holmes 1933), and that dry weather completely restricts the disease (Batko 1956; Peace 1936).

Investigations of fungicidal control of Meria needlecast have mostly involved the disease on European larch seedlings. Lime-sulfur and similar compounds have generally been effective (Cooley 1981; Hubert 1954). Other newer chemicals that are effective include benomyl and maneb (Cooley 1981), and tridimefon (Boudier 1981). Because numerous disease cycles are possible in a single growing season, inoculum buildup can be very rapid and the disease can reach epidemic proportions in a short time. Therefore, most reports emphasize the importance of initially applying fungicides early in the spring to restrict primary infection of new needles and keep inoculum low (Cooley 1981; Peace 1936; Peace and Holmes 1933). If fungicide treatments are postponed until extensive disease is evident, there is little chance for control (Peace and Holmes 1933). Therefore, it seems prudent for growers to initiate protective fungicide treatments early in the spring and continue treatments until warm, dry, summer weather prevails.

Occurrence of Meria needlecast on containerized larch was rather unexpected because the disease had not been reported previously on this type of crop. However, extremely high inoculum levels in nearby bareroot beds probably provided ample chances for infection of containerized stock. It is suspected that if the disease is controlled on bareroot seedlings, there will probably be little infection of containerized larch.

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